An unknown quantity of Motorola 12 inch video display units currently being used in customers' systems have a potential problem. When the display is turned OFF, the raster collapses into a bright spot in the center of the screen. This may destroy the phosphor of the CRT and is evidenced by a burn spot at screen center.

This problem is avoided by adding two components to the Motorola PC board as follows: (Reference page 8-28, 2200 Maintenance Manual)

1. Solder a 120Ω, 1/2 watt resistor (WL #331-2012) to the positive (+) lead of a 500 μF, 50 VDC electrolytic capacitor (WL #300-3053).

2. Solder the free end of the resistor to the 30 volt etch connected to pin 7 of the Motorola PC board.

3. Solder the negative lead of the electrolytic capacitor to the etch connecting to the base of transistor Q3.

If a unit is found to have a burned spot in the screen center, replace the unit with an updated unit per normal service procedures.
Tape cassettes date coded 7010 or 7011 were found to be wound upside-down during assembly. To determine whether this problem exists in your area, look at the tape surface. If the surface is shiny-side up, the tape is upside down in the cassette and should be replaced. The shiny surface is the Mylar® backing; the dull surface is the ferrous oxide recording surface.

Part numbers of these cassettes are as follows:

75' Cassette WL #174-1251
160' Cassette WL #174-1250
13' Cassette WL #177-0113
25' Cassette WL #177-0112
50' Cassette WL #177-0110

for:
1200 & 2200 Systems
500/600/700
Calculator Systems

In small quantities (3 or less), replace customer cassettes from service stock. In larger quantities, order replacement cassettes through standard sales channels.
ADDITION OF BLANKING CIRCUIT (7258)
TO
WANG CRT ELECTRONIC BOARDS
(7256)=12" MONITOR AND (7256-1)=9" MONITOR

September 29, 1977

A. GENERAL

The Wang CRT electronics 7256 (12") and 7256-1 (9") have been modified by the addition of a blanking circuit (7258). This circuit is contained on a small board which is attached to the CRT electronics board by four wires (3 top of board jumper type leads and 1 resistor leg extension feed-thru type lead).

B. REASON AND EXPLANATION OF MODIFICATION

The 7258 circuit provides both a blanking function and an improvement to the video driver circuit.

Previous problems were associated with poor contrast such as the vertical line at the right of the screen.

This modification "blanks" the CRT during all times when the video information is not present.

In addition, other corrective measures are accomplished during this modification to resolve the vertical line problem.

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C. INCORPORATION

This modification will be incorporated in the future artwork (etch lay-out) and the complete board assemblies will be reidentified as 7456 and 7456-1 respectively. Therefore, the 7256 and the 7456 boards will be directly interchangeable as will the 7256-1 with the 7456-1.

D. EXISTING VARIATIONS

Table 1 in conjunction with Figures 1A and 1B indicate the distinctions between the basic 7256 and 7256-1 boards. There are six basic component differences; their differences are indicated by table 1 and their board locations shown in Figures 1A and 1B.

<table>
<thead>
<tr>
<th>COMPONENT IDENTITY</th>
<th>WANG CRT ELEC. BOARD 7256</th>
<th>WANG CRT ELEC. BOARD 7256-1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>12&quot; MONITOR (FIGURE 1A)</td>
<td>9&quot; MONITOR (FIGURE 1B)</td>
</tr>
<tr>
<td>Z2</td>
<td>320-0053 width coil EX4062-1</td>
<td>320-0056 width coil EX4204</td>
</tr>
<tr>
<td>Z3</td>
<td>320-0051 linearity coil EX4063</td>
<td>320-0058 linearity coil EX4222</td>
</tr>
<tr>
<td>C18</td>
<td>300-2247 .47 micro-fd 100V mylar</td>
<td>300-2418 2.2 micro-fd 100V metal mylar</td>
</tr>
<tr>
<td>C30</td>
<td>300-2412 .033 micro-fd 400V metal mylar</td>
<td>300-2417 .015 micro-fd 400V metal mylar</td>
</tr>
<tr>
<td>C31</td>
<td>300-2413 4.0 micro-fd 100V metal mylar</td>
<td>300-2418 2.2 micro-fd 100V metal mylar</td>
</tr>
<tr>
<td>R19</td>
<td>330-3068 6.8K 1/4W</td>
<td>330-4027 27K 1/4W</td>
</tr>
</tbody>
</table>
FIGURE 1A. TWELVE INCH MONITOR - PCB 7256

FIGURE 1B. NINE INCH MONITOR - PCB 7256-1

FIGURE 1. ELECTRONIC BOARD LAY-OUT CONFIGURATION - (Differences)
E. FIELD MODIFICATION PROCEDURE

The following procedure specifies the steps necessary to incorporate the blanking circuit onto the twelve inch (7256) and the nine inch (7256-1) monitors.

1. Open/cut the ground etch in accordance with Figure 2, (1).

2. Add jumper for grounding in accordance with Figure 2, (2).

3. On the component side of the board, open/cut the ground etch between C13 and C20 in accordance with Figure 2, (3).

4. Change R26 from 470K to 1.2M (330-6012) in accordance with Figure 2, (4).

5. Adjacent to R26, drill two holes to mount a .02 micro-fd 600V capacitor (300-1912) in accordance with Figure 2, (5).
   a) One lead of the capacitor will be tied to R26.
   b) One lead of the capacitor will be tied to +0V.

6. Change R4 from 120 ohm to 22 ohm (300-1022) in accordance with Figure 2, (6).

7. Remove R11 and C4 in accordance with Figure 2, (7).

8. Remove R9 in accordance with Figure 2, (8). The removal of R9 also provides the mounting pads for two of the leads coming from the blanking circuit board (7258).

9. Add the blanking circuit board (7258) in accordance with Figure 2, (9) and Figure 3.
NOTE:
STEP F IS GIVEN AS INFORMATION ONLY. ALL BOARDS WILL HAVE THIS JUMPER INSTALLED AT THE TIME OF PRODUCTION.

F. PCB 7256-1 (9" MONITOR) Z2 JUMPER ADDITION

1. During manufacture, the coil lead was attached to the wrong post; therefore, Z2 was not connected between C31 and Z3.

2. Visually insure the insertion of a jumper from one coil post to the other (at each end of the Z2 coil) in accordance with Figure 2, (10).
This Service Bulletin describes recent changes to all 2200 System diagnostic programs on cassette, diskette, and minidiskette. Prior to this Service Bulletin, many diagnostic programs were without part numbers, and operating procedures were scattered throughout several publications.

This Service Bulletin now provides a convenient collection of all available 2200 System Diagnostic programs and operating procedures. Additionally, all 2200 Diagnostic programs now have part numbers, so that reordering is easy.

Section I of this Service Bulletin is a list of diagnostic programs by product. The products are in numerical order, and each product section describes where the diagnostic program can be found (cassette, diskette and/or minidiskette). Many products have diagnostic programs on all three types of media.

Section II lists the diagnostic programs by part number, with a list of products for which those diagnostic programs can be used. Operating instructions are included.

Section II also indicates the latest diagnostic revisions. As each 701-XXXX number is updated or changed, a letter will be added to the part number. Each revision increases the letter designation. For instance, the first 2200 Peripheral Diskette was designated 701-2180.
The first REVISION changed this to 701-2180A, the second to 701-2180B, and so on. Section III provides these revision levels so that you may be sure you are using the most recent diagnostic program.

Section III is a Diagnostic Program Discrepancy form. Although every effort was made to ensure each diagnostic program was documented properly and can be used in the configuration described, there may be errors or incomplete operating instructions. Whenever you find a discrepancy, please fill out the attached form and send it to Customer Engineering Division, Attn: Computer Support Department, at the Home Office. This is the best way to update these programs to provide you with the best possible diagnostic tests.
SECTION I
DIAGNOSTIC PROGRAMS BY PRODUCT

1. 2200A CPU
Cassette 701-0379. Refer to section 2.1.
1) REWIND Cassette
2) Key LOAD, EXECUTE
3) Key RUN, EXECUTE
4) When instructions are displayed, enter the appropriate numbers.
5) Observe results.

2. 2200B CPU
Cassette 701-0379. Refer to section 2.1.
1) REWIND Cassette
2) Key LOAD, EXECUTE
3) Key RUN, EXECUTE
4) When instructions are displayed, enter the appropriate numbers.
5) Observe results.

3. 2200C CPU
Cassette 701-0379. Refer to section 2.1.
1) REWIND Cassette
2) Key LOAD, EXECUTE
3) Key RUN, EXECUTE
4) When instructions are displayed, enter the appropriate numbers.
5) Observe results.

4. 2200E CPU
Cassette 701-0379. Use 2200T program on this cassette. Refer to section 2.1.
1) REWIND Cassette
2) Key LOAD, EXECUTE
3) Key RUN, EXECUTE
4) When instructions are displayed, enter the appropriate numbers.
5) Observe results.

5. 2200F CPU
   a) Diskette 701-2261 for multiplexed disk systems. Refer to section 2.11.
      1) Insert diskette, Key LOAD DCF "START", EXECUTE.
      2) Key RUN, EXECUTE.
      3) When instructions are displayed, enter the appropriate numbers.
      4) Observe results.
   b) Cassette 701-0379 may be used if Cassette Interface 190-0713 (210-7068) is available (use 2200T program). Refer to section 2.1.
      1) REWIND Cassette
      2) Key LOAD, EXECUTE
      3) Key RUN, EXECUTE
      4) When instructions are displayed, enter the appropriate numbers.
      5) Observe results.

6. 2200S CPU
   Cassette 701-0379. Refer to section 2.1.
   1) REWIND Cassette
   2) Key LOAD, EXECUTE
   3) Key RUN, EXECUTE
   4) When instructions are displayed, enter the appropriate numbers.
   5) Observe results.

7. 2200T CPU
   a) Diskette 701-2261. Refer to section 2.11.
      1) Insert diskette, Key LOAD DCP "START", EXECUTE.
      2) Key RUN, EXECUTE.
3) When instructions are displayed, enter the appropriate numbers.
4) Observe results.

b) Cassette 701-0379. Refer to section 2.1.
1) REWIND Cassette
2) Key LOAD, EXECUTE
3) Key RUN, EXECUTE
4) When instructions are displayed, enter the appropriate numbers.
5) Observe results.

8. 2200VP CPU
a) Machine microcode diagnostics, use diskette 701-2108X (current software release). Refer to 2200VP Maintenance Manual, Volume I.

b) Machine microcode diagnostics, use minidiskette 701-8069X (current software release). Refer to 2200 VP Maintenance Manual, Volume I.

c) BASIC-2 Language Diagnostic, use diskette 701-2261. Refer to section 2.11.
1) Insert diskette. Key SELECT DISK XYX, EXECUTE, where X=3 or B, YY = device address of diskette.
2) Key LOAD DCF "START", EXECUTE.
3) Key RUN, EXECUTE.
4) When instructions are displayed, enter the appropriate numbers.
5) Observe results.

d) Minidiskette 701-8080 for BASIC-2 Language Diagnostic. Refer to section 2.11.
1) Insert diskette. Key SELECT DISK XYX, EXECUTE, where X=3 or B, YY = device address of diskette.
2) Key LOAD DCF "START", EXECUTE.
3) Key RUN, EXECUTE.
9. 2200 PCS-II
Minidiskette 701-8000. Refer to section 2.12.
1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
2) Key LOAD DCF "START", EXECUTE.
3) Key RUN, EXECUTE.
4) When menu is displayed, follow instructions.

10. 2201 Output Writer
   a) Cassette 701-0419: Printers #2. Refer to section 2.2.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
      5) When next Menu is displayed, Key SF'01.
   c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
      5) When next Menu is displayed, Key SF'01.

11. 2202 Plotting Output Writer
    a) Cassette 701-0421: Plotters. Refer to section 2.4.
       1) REWIND Cassette.
       2) Key LOAD, EXECUTE.
       3) Key RUN, EXECUTE.
       4) When Menu is displayed, Key SF'01.
b) Diskette 701-2180: Peripherals. Refer to section 2.10.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
      X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'01.
   5) When next Menu is displayed, Key SF'02.

c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
      X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'01.
   5) When next Menu is displayed, Key SF'02.

12. 2203 Paper Tape Reader
   a) Cassette 701-0422 I/O #2. Refer to section 2.5.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03.
      5) When next Menu is displayed, Key SF'01.

   a) Cassette 701-0424: TC. Refer to section 2.7.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01 or 02.
b) Diskette 701-2180: Peripherals. Refer to section 2.10.
1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
2) Key LOAD DCF "START", EXECUTE.
3) Key RUN, EXECUTE.
4) When Menu is displayed, Key SF'02.
5) When next Menu is displayed, Key SF'01 or 02.

14. 2209 9 Track Tape Drive

Diskette 701-2180: Peripherals. Refer to section 2.10.
1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
2) Key LOAD DCF "START", EXECUTE.
3) Key RUN, EXECUTE.
4) When Menu is displayed, Key SF'03.
5) When next Menu is displayed, Key SF'02.

15. 2209A 1600 BPI Tape Drive

Not available at this time.

16. 2210 User Terminal (Keyboard, Video Display, Minidiskette)

a) Keyboard - Test by inspection.

b) Minidiskette and CRT - Use minidiskette 701-8000, disk and CRT programs. Refer to section 2.12.

17. 2212 Analog Flatbed Plotter

a) Cassette 701-0421: Plotters. Refer to section 2.4.
1) REWIND Cassette.
2) Key LOAD, EXECUTE.
3) Key RUN, EXECUTE.
4) When Menu is displayed, Key SF'02.

b) Diskette 701-2180: Peripherals. Refer to section 2.10.
1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
2) Key LOAD DCF "START", EXECUTE.
3) Key RUN, EXECUTE.
4) When Menu is displayed, Key SF'01.
5) When next Menu is displayed, Key SF'03.
c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where 
      X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'01.
   5) When next Menu is displayed, Key SF'03.

18. 2214 Marked Sense Card Reader 
    a) Cassette 701-0422: I/O #2. Refer to section 2.5.
       1) REWIND Cassette.
       2) Key LOAD, EXECUTE.
       3) Key RUN, EXECUTE.
       4) When Menu is displayed, Key SF'02.

19. 2215 Keyboard
    Test by inspection.

20. 2216 Video Display
    Test by inspection.

21. 2217/2218 Cassette Tape Drive
    Test by LOADING and SAVING a cassette, then CLEAR, LOAD same 
    cassette.

22. 2220 User Terminal (Keyboard, Video Display, Cassette Tape Drive) 
    Test all functions by inspection.

23. 2221 Matrix Printer (Centronics)
    a) Cassette 701-0420: Printer #1. Refer to section 2.3.
       1) REWIND Cassette.
       2) Key LOAD, EXECUTE.
3) Key RUN, EXECUTE.
4) When Menu is displayed, Key SF'01.

b) Diskette 701-2180: Peripherals. Refer to section 2.10.
1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
   X=3 or B, YY = device address of diskette.
2) Key LOAD DCF "START", EXECUTE.
3) Key RUN, EXECUTE.
4) When Menu is displayed, Key SF'01.
5) When next Menu is displayed, Key SF'04.

24. 2221W Matrix Printer (Wang)
   a) Cassette 701-0420: Printer #1. Refer to section 2.3.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
      5) When next Menu is displayed, Key SF'05.
   c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'02.
      5) When next Menu is displayed, Key SF'01.

25. 2222 Keyboard
    Test by inspection.

26. 2223 Keyboard
    Test by inspection.
27. 2224 Multiplexer  
   a) Cassette 701-0425: Disk. Refer to section 2.8.  
      1) REWIND Cassette.  
      2) Key LOAD, EXECUTE.  
      3) Key RUN, EXECUTE.  
      4) When Menu is displayed, enter appropriate number for test.  
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.  
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.  
      2) Key LOAD DCF "START", EXECUTE.  
      3) Key RUN, EXECUTE.  
      4) When Menu is displayed, Key SF'03.  
      5) When next Menu is displayed, Key SF'09, enter appropriate number for test.  

28. 2226 User Terminal (Keyboard, Video Display)  

Test by inspection.  

29. 2227 Asynchronous TC  
   a) Cassette 701-0424: TC. Refer to section 2.7.  
      1) REWIND Cassette.  
      2) Key LOAD, EXECUTE.  
      3) Key RUN, EXECUTE.  
      4) When Menu is displayed, Key SF'03.  
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.  
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.  
      2) Key LOAD DCF "START", EXECUTE.  
      3) Key RUN, EXECUTE.  
      4) When Menu is displayed, Key SF'02.  
      5) When next Menu is displayed, Key SF'03.
30. 2227B/OP 62 TC
   a) Cassette 701-0424: TC. Refer to section 2.7.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'04, 05 or 06.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'02.
      5) When next Menu is displayed, Key SF'05, 06, or 07.
   c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'05.
      5) When next Menu is displayed, Key SF'01, 02 or 03.

31. 2228B/OP 62B Bisync TC
   a) Cassette 701-0424: TC. Refer to section 2.7.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'04, 05 or 06.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'02.
      5) When next Menu is displayed, Key SF'04, 05, 06 or 07.
c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
      X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'05.
   5) When next Menu is displayed, Key SF'01, 02 or 03.

32. 2230 Disk Systems
    a) Cassette 701-0425: Disk. Refer to section 2.8.
       1) REWIND Cassette.
       2) Key LOAD, EXECUTE.
       3) Key RUN, EXECUTE.
       4) When Menu is displayed, enter 2, 3 or 4 for test.
    b) Diskette 701-2180: Peripherals. Refer to section 2.10.
       1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
          X=3 or B, YY = device address of diskette.
       2) Key LOAD DCF "START", EXECUTE.
       3) Key RUN, EXECUTE.
       4) When Menu is displayed, Key SF'03.
       5) When next Menu is displayed, Key SF'08.

33. 2230MXA/B Multiplexer
    a) Cassette 701-0425: Disk. Refer to section 2.8.
       1) REWIND Cassette.
       2) Key LOAD, EXECUTE.
       3) Key RUN, EXECUTE.
       4) When Menu is displayed, enter 2, 3 or 4 for test.
    b) Diskette 701-2180: Peripherals. Refer to section 2.10.
       1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
          X=3 or B, YY = device address of diskette.
       2) Key LOAD DCF "START", EXECUTE.
       3) Key RUN, EXECUTE.
       4) When Menu is displayed, Key SF'09.
       5) When next Menu is displayed, enter appropriate number
          for test.
34. 2231 Matrix Printer (Centronics)
   a) Cassette 701-0420: Printer #1. Refer to section 2.3.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
      5) When next Menu is displayed, Key SF'06.

35. 2231W Matrix Printer (Wang)
   a) Cassette 701-0420: Printer #1. Refer to section 2.3.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'04.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
      5) When next Menu is displayed, Key SF'07 or 08.
   c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'02.
      5) When next Menu is displayed, Key SF'02 or 03.
36. 2232 Digital Flatbed Plotter
   a) Cassette 701-0421: Plotter. Refer to section 2.4.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'08.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
      5) When next Menu is displayed, Key SF'09.
   c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
      5) When next Menu is displayed, Key SF'04.

37. 2234/34A Hopper-Feed Card Reader
   a) Cassette 701-0422: I/O #2. Refer to section 2.5.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03 or 04.

38. 2236 Interactive Terminal
   Diskette 701-2180: Peripherals. Refer to section 2.10.

39. 2240 Dual Drive Memorex Disk System
   a) Cassette 701-0425: Disk Systems. Refer to section 2.8.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
3) Key RUN, EXECUTE.
4) When Menu is displayed, enter 7 or 8 for test.

b) Diskette 701-2180: Peripherals. Refer to section 2.10.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
      X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'03.
   5) When next Menu is displayed, Key SF'08, then enter 7 or
      8 for test.

40. 2241 Thermal Head Printer
   a) Cassette 701-0420: Printer #1. Refer to section 2.3.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'05.

41. 2242 Single Drive Memorex Disk System and 2243 Triple Drive
     Memorex Disk System
   a) Cassette 701-0425: Disk Systems. Refer to section 2.8.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, enter 9 or 10 for test.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03.
      5) When next Menu is displayed, Key SF'08, then enter 9 or
         10 for test.
42. 2244/44A Hopper-Feed Card Reader
   a) Cassette 701-0422: I/O #2. Refer to section 2.5.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03 or 04.

43. 2250 8-Bit Parallel I/O Interface
   a) Cassette 701-0423: I/O #1. Refer to section 2.6.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03.
      5) When next Menu is displayed, Key SF'03.
   c) Minidiskette 701-8001: Peripherals (OP 67). Refer to
      section 2.13.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'04.
      5) When next Menu is displayed, Key SF'01.

44. 2251 Matrix Printer
   a) Cassette 701-0419: Printer #2. Refer to section 2.2.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'05.
45. 2252A Scanning Input Interface
   a) Cassette 701-0423: I/O #1. Refer to section 2.6.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'02 or 03.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03.
      5) When next Menu is displayed, Key SF'04 or 05.

46. 2254 IEEE Bus Interface
   a) Cassette 701-0423: I/O #1. Refer to section 2.6.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'04.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03.
      5) When next Menu is displayed, Key SF'06.
   c) Minidiskette 701-8001: Peripherals (OP 65). Refer to
      section 2.13.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03.
      5) When next Menu is displayed, Key SF'01.
47. 2260 10Mbyte and 2260-2 20Mbyte Disk Systems
   a) Cassette 701-0425: Disk Systems. Refer to section 2.8.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, enter 5 or 6 for test.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'03..
      5) When next Menu is displayed, Key SF'08, then enter 5 or
         6 for test.

48. 2261 Matrix Printer (Centronics)
   a) Cassette 701-0420: Printer #1. Refer to section 2.3.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'06.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
         X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
      5) When next Menu is displayed, Key SF'04.

49. 2261W Matrix Printer (Wang)
    Not available at this time. Use 2221W Program.

50. 2262 Digitizer
    Diskette 701-2180: Peripherals. Refer to section 2.10.
    1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where
       X=3 or B, YY = device address of diskette.
2) Key LOAD DCF "START", EXECUTE.
3) Key RUN, EXECUTE.
4) When Menu is displayed, Key SF'03.
5) When next Menu is displayed, Key SF'07.

51. 2263 High Speed Line Printer
Not available at this time. Use 2221W Program.

52. 2270-1, 2270-2, 2270-3 Diskette Systems
a) Cassette 701-0425: Disk Systems. Refer to section 2.8.
   1) REWIND Cassette.
   2) Key LOAD, EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, enter 8, 9 or 10 for test.

b) Diskette 701-2180: Peripherals. Refer to section 2.10.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'03.
   5) When next Menu is displayed, Key SF'08, then enter 8, 9 or 10 for test.

53. 2271 Bidirectional Output Writer
a) Cassette 701-0419: Printer #2. Refer to section 2.2.
   1) REWIND Cassette.
   2) Key LOAD, EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'03.

b) Diskette 701-2180: Peripherals. Use 2281 program.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'01.
   5) When next Menu is displayed, Key SF'01.
c) Minidiskette 701-8001: Peripherals. Use 2281 Program.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'02.
   5) When next Menu is displayed, Key SF'04.

54. 2272 Digital Drum Plotter
   a) Cassette 701-0421: Plotters. Refer to section 2.4.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'09 or 10.
   b) Diskette 701-2180: Peripherals. Refer to section 2.10.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'01.
      5) When next Menu is displayed, Key SF'10 or 11.
   c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
      1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
      2) Key LOAD DCF "START", EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'02.
      5) When next Menu is displayed, Key SF'05 or 06.

55. 2281 Daisy Wheel Output Writer
   a) Cassette 701-0419: Printer #2. Refer to section 2.2.
      1) REWIND Cassette.
      2) Key LOAD, EXECUTE.
      3) Key RUN, EXECUTE.
      4) When Menu is displayed, Key SF'04.
b) Diskette 701-2180: Peripherals. Refer to section 2.10.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'01.
   5) When next Menu is displayed, Key SF'02.

c) Minidiskette 701-8001: Peripherals. Refer to section 2.13.
   1) Insert diskette. Key SELECT DISK XYY, EXECUTE, where X=3 or B, YY = device address of diskette.
   2) Key LOAD DCF "START", EXECUTE.
   3) Key RUN, EXECUTE.
   4) When Menu is displayed, Key SF'02.
   5) When next Menu is displayed, Key SF'04.

56. 2282 Graphics Terminal
    Not available at this time.

57. OP61 - See 2201

58. OP62 - See 2227B

59. OP62B - See 2228B

60. OP65 - See 2254

61. OP67 - See 2250
SECTION II
DIAGNOSTIC PACKAGES

2.1 Cassette 701-0379: 2200 BASIC Diagnostic

1. CPU Diagnostics 2200A, 2200B, 2200C, 2200S, 2200T, 2200E, and 2200F.

2. Diagnostics tests all possible functions that can be performed by the CPU.

3. Operating Instructions:
   a) Key LOAD, EXECUTE.
   b) Key RUN, EXECUTE.
   c) Enter corresponding # for desired CPU:
      1) 1 for 2200A.
      2) 2 for 2200S.
      3) 3 for 2200B.
      4) 4 for 2200C.
      5) 5 for 2200T.

4. As the diagnostic is running, it will display the function performed and if any errors were encountered during this operation. Program will continue even if errors were encountered. At the end of the test, an error list will be generated. The diagnostic program is in a loop, so when the error list is generated, the diagnostic will automatically start over, to terminate key reset.

2.2 Cassette 701-0419: Printer #1 Diagnostics. 2201, 2251, 2271, and 2281

1. Tests on all printers checks mechanical movements of carriage return, line feed, and print head movement. Also checks logic that shows if the right solenoids are being strobed for the corresponding characters.
2. Operating Instructions:
   a) Key LOAD, EXECUTE.
   b) Key RUN, EXECUTE.
   c) Key desired special function key for appropriate printer/printers.
      1) SF'1 for 2201.
      2) SF'2 for 2251.
      3) SF'3 for 2271.
      4) SF'4 for 2281.
   d) Enter # of times test is to be executed.
   e) Key EXECUTE.

3. The only error analysis check is a visual one. The printer will print out all characters associated with that printer and will perform all mechanical movements required of that printer during operation (i.e., carriage return, line feed, tab). When a mechanical test is performed, a message will be printed acknowledging that the operation has been done.

   A visual check has to be performed on the numerics and alphanumerics to see if the solenoids and print wire heads are all working properly.

2.3 Cassette 701-0420: Printer #2 Diagnostics. 2221, 2221W, 2231, 2231W, 2241, and 2261

   SF'01 for 2221   SF'04 for 2231W
   SF'02 for 2221W  SF'05 for 2241
   SF'03 for 2231   SF'06 for 2261

   Refer to 2.2 for operating instructions.

2.4 Cassette 701-0421: Plotter Diagnostics. 2202, 2212, 2232, and 2272

1. All electrical signals and mechanical movement of the arms, pens, and carriage of the plotters are performed.
2. Operating Instructions:
   a) Key LOAD, EXECUTE.
   b) Key RUN, EXECUTE.
   c) Key desired special function key for appropriate diagnostic.
      1) SF'1 for 2202.
      2) SF'2 for 2212.
      3) SF'8 for 2232.
      4) SF'9 for 2272-1.
      5) SF'10 for 2272-2.

3. As the plotter goes through the test, if a circle is to be
drawn, a message on the screen will say a circle is being
drawn and the only check there is, is a visual check that a
circle is being drawn, etc. Some plotters will have special
function keys of various plots to be drawn which can be
selected.

2.5 Cassette 701-0422: I/O #1 Diagnostics. 2203, 2234/44, 2234A/44A,
and 2214

1. All diagnostics tests check each product thoroughly, doing
   operations that are necessary for the operation of the
   product. All mechanical movement and electrical signals are
tested to their fullest extent.

2. Operating Instructions:
   a) Key LOAD, EXECUTE.
   b) Key RUN, EXECUTE.
   c) Key desired special function key for appropriate product.
      1) SF'1 for 2203.
      2) SF'2 for 2214.
      3) SF'3 for 2234/44.
      4) SF'4 for 2234A/44A.

3. As errors are encountered in the test, the test will imme-
diately stop and an error message will display indicating
the problem with the product.
2.6 Cassette 701-0423 I/O #2 Diagnostics 2250, 2252, 2252A, and 2254

a) Key LOAD, EXECUTE.
b) Key RUN, EXECUTE.
c) Key desired special function key for appropriate product:
   1) SF'01 for 2250
   2) SF'02 for 2252
   3) SF'03 for 2252A
   4) SF'04 for 2254

2.7 Cassette 701-0424: TC Diagnostics. 2207, 2207 with teletype, 2227, 8K 2227B/28B, 16K 2227B/28B, and 27B/28B Teletype Emulator

1. Diagnostics test all communication from the controllers to and from the CPUs.

2. Operating Instructions:
a) Key LOAD, EXECUTE.
b) Key RUN, EXECUTE.
c) Key desired special function key for desired diagnostic.
   1) SF'1 for 2207.
   2) SF'2 for 2207 with TTY.
   3) SF'3 for 2227.
   4) SF'4 for 8K 2227B/28B.
   5) SF'5 for 16K 2227B/28B.
   6) SF'6 for 2227B/28B TTY emulator.

3. Any errors that occur will immediately stop the diagnostic and display the error.

2.8 Cassette 701-0425: Disk System Diagnostics. 2210, 2230-1, 2230-2 or 2260B, 2230-3 or 2260B, 2260, 2260-2, 2240-1, 2270-2 or 2240-2, 2270-1 or 2242, 2270-3 or 2243, 2230MXA/B, and 2224 disk multiplexers
1. All disk diagnostics perform all functions associated with disks (i.e., Read, Write, Verify, Copy, Move) and does these operations many times to test the operation of the disk. All mechanical movement of heads and other mechanical parts are also exhaustively checked.

2. Operating Instructions.
   a) Key LOAD, EXECUTE.
   b) Key RUN, EXECUTE.
   c) Key desired special function key for appropriate diagnostic.

3. As each operation is being checked, a record is kept and if there are any errors on certain operations it will be displayed. The associated hardware for the operation will then have to be checked.

2.9 Diskette 701-2046C: 2200 Hardware Diagnostic (Part of WCS System auto-enclosures)

Tests:

1. Memory
   a) 4K-32K in increments of 4K.
2. CPU 2200T.
3. Printers (2201, 2221, 2221W, 2231, and 2261).
4. Disks (2230-1,-2,-3, 2260).

2.10 701-2180B

2.10.1 OUTPUT WRITERS/PRINTERS/PLOTTERS:

1. 2201, 2202, 2212, 2221/61, 2221W, and 2231, 2231W 12 pitch, 2231W 10 pitch, 2232, 2272-1, 2272-2, and 2281.
   a) Insert diskette into drive. Key Select disk XXY.
   b) Key LOAD DCF "START".
c) When menu is displayed, Key SF'1.
d) When new menu is displayed, key corresponding SF Key of device to be tested.
e) Verify operation of device.

a) When menu is displayed, Key SF'2.
b) When new menu is displayed, Key corresponding SF Key for device to be tested.

a) When menu is displayed, Key SF'3.
b) When new menu is displayed, Key corresponding SF Key for device to be tested.

4. Disk Systems: 2210, 2260-2, 2230-1 or 2260B 1/8, 2230-2 or 2260B 1/4, 2230-3 or 2260B 1/2, 2260, 2240-1 2270-2 or 2240-2, 2270-1 or 2242, 2270-3 or 2243, and 2224 and 2230 MXA/B Disk Multiplexer.
a) When menu is displayed, Key SF'3.
b) When new menu is displayed, Key SF'8.
c) When new menu is displayed, Key corresponding SF Key for device to be tested.

2.11 701-2261: 2200C, 2200T, 2200VP CPU Diagnostic Diskette

Tests 2200C, 2200T, 2200VP BASIC Language.
a) Key LOAD DCF "START".
b) Key RUN, EXECUTE.
c) Enter appropriate number as necessary.

2.12 701-8000: PCS II Minidiskette

Tests PCS II CPU, Minidiskette, CRT, Memory.
a) Key LOAD DCF "START", EXECUTE.
b) Key RUN, EXECUTE.
c) Enter appropriate number for desired tests.
   1) #1 for CPU.
   2) #2 for Memory.
   3) 3 for Disk.
   4) 4 for CRT (80 x 24).
   5) 5 for CRT (64 x 16).

2.13 701-8001A: PCSI II Peripherals Minidiskette


a) Key LOAD DCF "START", EXECUTE.
b) Key RUN, EXECUTE.
c) When menu is displayed, key desired special function key for test:
   1) SF'2 for printer and plotters.
   2) SF'3 for OP65.
   3) SF'4 for OP67.
   4) SF'5 for OP62 & 62B.

2.14 701-8080: 2200VP BASIC Diagnostic Minidiskette

Tests 2200VP BASIC Language.

a) Key LOAD RUN, EXECUTE.
SECTION III
DIAGNOSTIC PROGRAM DISCREPANCY REPORT

ORIGINATOR: ______________________ DATE: __________

OFFICE: _____________________________

DIAGNOSTIC PART NUMBER: (INCLUDE REVISION LEVEL LETTER DESIGNATION)

______________________________

Is there a documentation error? ___yes  ___no
If so, please indicate the correction required (or attach the corrected instructions).

______________________________

______________________________

Is there a programming error? ___yes  ___no
If so, please describe the problem.

______________________________

______________________________

Does the program always fail? ___yes  ___no
Which program?

______________________________

Does the program never fail? ___yes  ___no
Which program?

______________________________

Any other problem?

______________________________

______________________________

Describe the system configuration, to include CPU model and memory size:

______________________________

______________________________
REFERENCE DOCUMENTATION: 1200/1222 MAINTENANCE MANUAL VOLUME 2
DRAWING #D5996-94 (3 SHEETS)

NOTE:
Before attempting alignment of the Pinch Roller assembly, ensure that the Roller and Capstan Shaft are clean and in good condition.

PROCEED AS FOLLOWS (Ref: Figure, next page):

1. Loosen the lock nut on the Solenoid Arm.

2. Place Gap Gauge D-22-393 (WL #726-9606) over Left (forward) Solenoid Plunger, between Plunger washers and Solenoid Housing; use the .030 in. (.76 mm) section of the Gap Gauge.

3. The next step is to electrically actuate the Pinch Roller Solenoid and the Head-In Solenoid; however, to actuate these solenoids, it is necessary to block the light at the End-of-Tape Sensors. Place an opaque material over the lamp housings. The Forward Solenoid washers and Solenoid Housing should now bottom against the .030 in. (.76 mm) section of the Gap Gauge.

4. Adjust screw 'A' until Pinch Roller rolls lightly on the Capstan Shaft. Note that clockwise adjustment of 'A' moves the Roller closer to the Capstan; counterclockwise adjustment of 'A' moves the Roller away from the Capstan.

5. Push the Gap Gauge in further, until the Solenoid Plunger is bottomed against the .055 in. (1.39 mm) section of the Gauge. At this point, the Pinch Roller should not touch the Capstan.
Shaft. If the Pinch Roller is still touching the Capstan Shaft, repeat steps 4 and 5 until proper conditions are satisfied.

6. Retighten the lock nut while holding screw 'A' stationary when proper adjustment has been achieved.

7. Adjust Right (reverse) Solenoid per steps 2 and 3, using the .037 in. (.940 mm) section of the Gap Gauge instead of the .030 in. (.76 mm) section. Repeat steps 4-6 for the Right (reverse) Solenoid.
Service Newsletter NO. 88A
2200/2600 #16A
December 14, 1977

CHECKOUT PROCEDURE FOR 2200 SYSTEM HOG MODE

Service Newsletter #88 described the implementation of $GIO 'Hog Mode' in 2200 Systems.

Service Newsletter #88 failed to describe the method of testing the $GIO 'Hog Mode' and certain software user manuals describe the test incorrectly. For example, the ISS-3 User Manual says the statement $GIO/310(4480,A$) will 'hang-up' if the $GIO ECNs are not implemented. This is incorrect; the colon will return whether the $GIO ECNs are implemented or not.

To test the $GIO 'Hog Mode', use the following procedure:

1) Key RESET on all CPUs.
2) Enter $GIO/3X0(4480,A$), EXECUTE.
3) Enter LIST DCF, EXECUTE from another CPU. This CPU should 'hang-up'. Key RESET.
4) Perform step 3 on the other CPUs, one at a time, until all CPUs are tested.
5) Enter $GIO/3X0(4400,A$), EXECUTE, on the CPU step 2 was performed on. This releases 'Hog Mode' and all CPUs should have access to the disk.
6) Perform steps 2-5 on all other CPUs, one at a time, until all have been tested.

If any CPU can access the disk while one CPU supposedly has the disk 'hogg'd' by the $GIO statement, then that CPU's $GIO 'Hog Mode' does NOT work. No CPU should have access to the disk until the 'hogg'ing CPU is either RESET or $GIO/3X0(4400,A$) is executed.

Also note that once $GIO 'Hog' is set, it CANNOT be reset by a disk operation to the normal disk address. It MUST be reset by one of the above conditions.

Always be sure to check the 'Hog Mode' (both $GIO and standard 'Hog Mode') on ANY multiplexed system, ESPECIALLY those using KFAM or ISS.
With the increasing number of 2200 CPUs and their variations now in the field, the method of identifying these CPUs is becoming increasingly difficult. This Newsletter will help you identify the type of CPU by looking at the Model Number printed on the Model Label. The Model Label can be found on the left side of PCS/WS products and on the bottom of 2200 S/T/VP CPUs.

In the future, the WL Part Number will be used on the Model Label. This information is also included in this Newsletter. Additionally, new model numbers are being assigned to systems which are sold to the government under GSA contract. These government systems are called DDS (Digital Data Acquisition System) and are nothing more than 2200 Computer Systems sold under another name.
**PORTABLE COMPUTING SYSTEMS**

<table>
<thead>
<tr>
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<th>PART NUMBER</th>
<th>DESCRIPTION</th>
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<td>177-22E2</td>
<td>2200E; 8K MEMORY; 64 x 16 CRT</td>
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<td>177-22E4</td>
<td>2200E; 16K MEMORY; 64 x 16 CRT</td>
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<td>177-2EE2-1B</td>
<td>PCSII; 8K MEMORY; 80 x 24 CRT; SINGLE DRIVE</td>
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<td>177-2EE2-2A</td>
<td>PCSII; 8K MEMORY; 64 x 16 CRT; DUAL DRIVE</td>
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<tr>
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<td>2200 F4A</td>
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**PCS/WS OPTION/CONVERSIONS**

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<td>OP61</td>
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<td>OP62</td>
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<td>80 x 24 DISPLAY</td>
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<td>OP67</td>
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<td>8 BIT PARALLEL I/O (2250 EQUIV.)</td>
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<td>177-2200-31</td>
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<td>2200VP-4</td>
<td>177-3000</td>
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<td>177-3002</td>
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<td>177-3004</td>
<td>2200VP CPU; 9 I/O; 48K MEMORY</td>
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<td>177-3006</td>
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### 2200 CPU OPTIONS/CONVERSIONS

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<td>177-2200-20</td>
<td>3 ADDITIONAL I/O SLOTS</td>
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<td>OP20A</td>
<td>177-2200-2A</td>
<td>6 ADDITIONAL I/O SLOTS</td>
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<td>OP21</td>
<td>177-2200-21</td>
<td>MATRIX ROM FOR 2200S</td>
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<td>OP22</td>
<td>177-2200-22</td>
<td>ADVANCED PROGRAMMING ROM FOR 2200S</td>
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<td>177-2200-23</td>
<td>GENERAL I/O ROM FOR 2200S</td>
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<td>177-2200-24</td>
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<td>177-2200-8J</td>
<td>8K STEP MEMORY OPTION (6707-1)</td>
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<td>16K STEP MEMORY UPGRADE FOR 2200VP</td>
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<td>177-3010</td>
<td>32K STEP MEMORY UPGRADE FOR 2200VP</td>
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### 2200 SYSTEMS SOLD UNDER GSA PURCHASE AGREEMENTS

#### WANG DDS-5 SERIES

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<tbody>
<tr>
<td>DDS-5</td>
<td>Portable Computing System with 8K Bytes, 9-inch CRT (64 x 16 Upper/Lowercase Display), Single Cassette and Keyboard (2200 EZ)</td>
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<tr>
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<td>110 CPS Printer, 40 Character Line (2251)</td>
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<tr>
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<td>The above Sub-System must include one of the following interfaces:</td>
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<td>DDS-5A</td>
<td>RS-232-C Interface (OP62)</td>
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<tr>
<td>DDS-5B</td>
<td>8 Bit Parallel I/O Interface (OP67)</td>
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<tr>
<td>DDS-5C</td>
<td>IEEE-488-1975 (ASCII BUS) Interface (OP65)</td>
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# WANG DDS-10 SERIES

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>DESCRIPTION</th>
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</table>
| DDS-10       | CPU with 8K Memory and 3 I/O Slots (2200S-2)  
9" Console CRT/Keyboard, Tape Cassette (2220)  
110 CPS Printer, 40 Character Line (2251)  
The above Sub-System must include one of the following interfaces: |
| DDS-10A      | RS-232-C Interface (2227B) |
| DDS-10B      | 8 Bit Parallel I/O Interface (2250) |
| DDS-10C      | IEEE-488-1975 (ASCII BUS) Interface (2254) |
| DDS-10D      | 10 Digit BCD Input Interface (2252A) |
| DDS-10E      | 4 Bit Binary Input Device designed to interface to a Baird Atomic 35U-3 Emission Spectrometer (9011) |
| DDS-10F      | Bisynchronous Communications Controller (2228B) |

# WANG DDS-15 SERIES

<table>
<thead>
<tr>
<th>MODEL NUMBER</th>
<th>DESCRIPTION</th>
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</table>
| DDS-15       | CPU with 8K, 6 I/O Slots, 12" CRT and Keyboard, Single Removable Diskette Drive with 262,144 bytes of storage capacity, and console desk (WCS-20)  
110 CPS Printer, 40 Character Line (2251)  
The above Sub-System must include one of the following interfaces: |
| DDS-15A      | RS-232-C Interface (2227B) |
| DDS-15B      | 8 Bit Parallel I/O Interface (2250) |
| DDS-15C      | IEEE-488-1975 (ASCII BUS) Interface (2254) |
| DDS-15D      | 10 Digit BCD Input Interface (2252A) |
| DDS-15E      | 4 Bit Binary Input Device designed to interface to a Baird Atomic 35U-3 Emission Spectrometer (9011) |
| DDS-15F      | Bisynchronous Communications Controller (2228B) |
## WANG DDS-20 SERIES

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<tbody>
<tr>
<td>DDS-20</td>
<td>CPU with 8K, 6 I/O Slots, 12&quot; CRT and Keyboard, Single Removable Diskette Drive with 262,144 bytes of storage capacity, and console desk (WCS-20) 2nd Diskette Drive including another 262,144 bytes of storage capacity 110 CPS Printer, 40 Character Line (2251) <strong>The above Sub-System must include one of the following interfaces:</strong>  DDS-20A</td>
</tr>
<tr>
<td>DDS-20B</td>
<td>8 Bit Parallel I/O Interface (2250)</td>
</tr>
<tr>
<td>DDS-20C</td>
<td>IEEE-488-1975 (ASCII BUS) Interface (2254)</td>
</tr>
<tr>
<td>DDS-20D</td>
<td>10 Digit BCD Input Interface (2252A)</td>
</tr>
<tr>
<td>DDS-20E</td>
<td>4 Bit Binary Input Device designed to interface to a Baird Atomic 35U-3 Emission Spectrometer (9011)</td>
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<tr>
<td>DDS-20F</td>
<td>Bisynchronous Communications Controller (2228B)</td>
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## WANG DDS-25 SERIES

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<tbody>
<tr>
<td>DDS-25</td>
<td>CPU with 8K Memory and 3 I/O Slots with Expanded Capacity to 6 I/O Slots (2200T6) 9&quot; Console CRT, Keyboard, Tape Cassette (2220) 110 CPS Printer, 40 Character Line (2251) Fixed Removable Disk Drive with 5 million bytes of storage capacity (2260B 1/2) <strong>The above Sub-System must include one of the following interfaces:</strong>  DDS-25A</td>
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<tr>
<td>DDS-25B</td>
<td>8 Bit Parallel I/O Interface (2250)</td>
</tr>
<tr>
<td>DDS-25C</td>
<td>IEEE-488-1975 (ASCII BUS) Interface (2254)</td>
</tr>
<tr>
<td>DDS-25D</td>
<td>10 Digit BCD Input Interface (2252A)</td>
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<tr>
<td>DDS-25E</td>
<td>4 Bit Binary Input Device designed to interface to a Baird Atomic 35U-3 Emission Spectrometer (9011)</td>
</tr>
<tr>
<td>DDS-25F</td>
<td>Bisynchronous Communications Controller (2228B)</td>
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WANG DDS-30 SERIES

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<tbody>
<tr>
<td>DDS-30</td>
<td>CPU with 16K, 6 I/O Slots, 12&quot; CRT and Keyboard, Single Removable Diskette Drive with 262,144 bytes of storage capacity and console desk. Fixed Removable Disk Drive with 5 million bytes of storage capacity (WCS-30 less 2221W) 110 CPS Printer, 40 Character Line (2251) The above Sub-System must include one of the following interfaces: DDS-30A RS-232-C Interface (2227B) DDS-30B 8 Bit Parallel I/O Interface (2250) DDS-30C IEEE-488-1975 (ASCII BUS) Interface (2254) DDS-30D 10 Digit BCD Input Interface (2252A) DDS-30E 4 Bit Binary Input Device designed to interface to a Baird Atomic 35U-3 Emission Spectrometer (9011) DDS-30F Bisynchronous Communications Controller (2228B)</td>
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WANG DDS-40 SERIES

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<tr>
<td>DDS-40</td>
<td>CPU with 16K and 9 I/O (2200VP-4) 12&quot; Console CRT, and Keyboard (2226) Single Removable Diskette Drive with 262,144 bytes of storage capacity (2270) Fixed Removable Disk Drive with 5 million bytes of storage capacity (2260B 1/2) Wang Line Printer (200 CPS/132 Columns) (2221W) Console Desk The above Sub-System must include one of the following interfaces: DDS-40A RS-232-C Interface (2227B) DDS-40B 8 Bit Parallel I/O Interface (2250) DDS-40C IEEE-488-1975 (ASCII BUS) Interface (2254) DDS-40D 10 Digit BCD Input Interface (2252A) DDS-40E 4 Bit Binary Input Device designed to interface to a Baird Atomic 35U-3 Emission Spectrometer (9011) DDS-40F Bisynchronous Communications Controller (2228B)</td>
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</tbody>
</table>
The ROMs used in the various 2200 S/T CPUs have been changed several times in the past few months. To clarify the various ROM loadings and functions, they are summarized below:

1. There are several ROM boards presently in use in the field. They are:

- 6725 - 2200S only, no options
- 6735A or 7025A - 2200S, no options or option 21
- 6735B or 7025B - 2200S with option 22
- 6735C or 7025C - 2200S with option 23
- 6735D or 7025D - 2200S with option 24, or 2200T
- 6735E or 7025E - 2200S with option 24 or 2200T with or without option 33 (can be used in 2200T without option 33 but must be installed in unit with option 33). Option 33 is the 80 x 24 CRT as described in SN #37, 2200 #9.

2. The ROM loading for the various software levels of the boards has caused some confusion. Refer to the following chart for the 7025 and 7052 loading variations:

<table>
<thead>
<tr>
<th>LOC</th>
<th>2200S</th>
<th>W/OP22</th>
<th>2200T</th>
<th>2200T</th>
</tr>
</thead>
<tbody>
<tr>
<td>210-7025-A</td>
<td>210-7025-B</td>
<td>210-7025-C</td>
<td>210-7025-D</td>
<td>210-7025-E</td>
</tr>
<tr>
<td>L1</td>
<td>377-0294</td>
<td>377-0294</td>
<td>377-0294</td>
<td>377-0294</td>
</tr>
<tr>
<td>L4</td>
<td>377-0307</td>
<td>377-0307</td>
<td>377-0307</td>
<td>377-0307</td>
</tr>
<tr>
<td>L5</td>
<td>377-0335</td>
<td>377-0335</td>
<td>377-0335</td>
<td>377-0335</td>
</tr>
</tbody>
</table>

Loc for 210-7052

L1 377-0303
L2 377-0284
L3 377-0328
L4 377-0284
L5 377-0284
L6 377-0284
L7 377-0284
L8 377-0284
L9 377-0284
L10 377-0284
L11 377-0284
L12 377-0284
L13 377-0284
L14 377-0284
L15 377-0284
L16 377-0284
L17 377-0284
L18 377-0284
L19 377-0284
L20 377-0284
L21 377-0284
L22 377-0284
L23 377-0284
L24 377-0284
L25 377-0284
L26 377-0284
L27 377-0284
L28 377-0284
L29 377-0284
L30 377-0284
3. Finally, all 2200E, 2200F and 2200T ROMs are now software version E. The 7025E can be used in any 2200T but MUST be used in a 2200T with option 33 (80 x 24 CRT). That is, a 7025D can be replaced by a 7025E, but a 7025E cannot be replaced by a 7025D. Also, effective with 2200T serial number EM3690 and up, all 2200T CPUs have 7025E ROMs installed.

4. If the software version of a ROM board is changed, always be sure to change the identification label on that board.
A capacitor originally specified for the 7256 board has been found not to meet specifications. The capacitor is C31, WLI #300-2413, manufactured by Electrocube. The capacitor has a vendor part number of 230B1C405K, ratings of 4 uf, 200 vdc, and measures approximately 1.3 inches long by .5 inches diameter. This part is no longer stocked, and if the same Wang part number is ordered, a 4 uf, 100V capacitor will be sent, with dimension of 2 inches long and 1 inch diameter.

If you have 7256 boards with the Electrocube capacitor, replace them with the new, larger one.
2200 MAINTENANCE MANUAL

CPU - ROM, Arith./Logic Circuitry, Sys. Control Logic, I/O interface, 3.4K 24-pin RAM
PS - either in CPU (2200 S,T) or separate (22000 PS for A,B,C CPU cards)
User Terminal: 2215, 2222/3 Kybord w/12" diagonal scan (2214/24) or (2220) &
Model TD 24 digital tape cassette drive (2214)

Consoles: 1. 2214/17 console - 12" video display w/ TD24 cassette drive
       Kybord separate (2215/22/23)
2. 2220 console - 9" video display w/ TD 24 cassette dr. & upper/lower case Kybord Kybord like 2223
3. 2226 console - 12" v. display w/ upper/upper case Kybord Kybord like 2223

* Serial Tab - real panel usually - model #, mem size (if applicable), I/O switch, H2, Y, W
Memory Sizes: 8+4K = 32K

2200 SPEC: 115 or 230V, 50/60 H2, temp. 65°-70° C, humidity 40-60% RH

2200 A, B, C - 4K = 32K in 4 or 8K increments

6-11 I/O slots
2200 S,T - 8/16/24, or 32K 3, 6, or 9 I/O slots

INSTALLATION

Hi Temp - Higher component failure rate, cause warping & distortion of disk storage
Air Cond. - must be on separate power line or can cause sys. EML when:

* Cold Weather: Humidity 40-50% 10% Carpet should be non-static

If EML conductive mat, used over carpet to stop static, make sure conn. to EART
Sys. should have own power line if possible, must be noise free
V should not vary more than ±10% if other should use constant V. Tran.

If noise on line cannot be found, EMI filter w/cut off freq. near 10K H2 should be inserted

Power line installed in steel conduit & conduit conn. properly to jack box

DISK DEVICE ADDRESS

3 digit hex # 1st digit - device type
1st hex digit - 0 - Console input/output devices & 2209 9-trk. mag tape unit

1 - Tape cassette drives

2 - W/LP auto line feeds AFT. carriage return; digitizers & some telecom. sys.

3 - Disk drives

4 - Plotters; w/ Teletype PT unit to turn paper-tape unit; suppresses carriage return/line feed, format spaces, or NULL char.

5 - 2214 Card Reader

6 - 2234A/44A Stack Card Readers

3 digit device addr. printed on mounting bracket of controller circ. board

2 types of device addr. sw. on control brd. - 5 bank & 8 bank rocker types

Only last 2 digits set into switches, 1st digit 10's class of device

Set switches 5-8, high order = binary value of 2nd digit

1-4, low order = binary value of 3rd digit

RAM size selections - 2200 A/B/C - 6309 pc. 2200 S/T - 6709 pc

6309 - 2 types - 1 w/ 5 bank rocker sw. 2. Jumper wires in place of sw.

6309 w/ jumper wires 4K = 14, 8K = 12, 12K = 10, 20K = 8K = 0

6309 sw. settings 4K = 0, 8K = 4, 12K = 2, 16K = 6, 20K = 1, 24K = 5, 28K = 3

Installation

1. Check for damage, check all connectors seated properly, verify sw. settings & voltages

2. Conn. periph. to CPU I/O controller, make sure correct controller

3. Plug main power from CPC into 2200 A/B/C PS

4. W/ all power on sw/ OFF plug in all AC cords

5. Sw. CPU on & get ready on VDisplay

6. Run appropriate diagnostics to check EA unit in sys. (CPU, options, periph.

7. Manual keyb. operation

8. Options must be installed by WANG CF
SELECT STAT - USED TO SELECT I/O DEVICES (IMMEDIATE OR PROGRAMMABLE USE)

REQUIRES PRINT, LIST OR CO & DEVICE TYPE CODE BE CONTAINED IN STAT

LINE LENGTH CAN ALSO BE SPECIFIED

DEVICE TYPE DETERMINES WHICH INTERNAL 2200 I/O ROUTINE USED TO CONTROL

DEVICE TYPE 0 - USED W/ DEVICES WHICH DON'T AUTO EXECUTE LINE FEED AFT. CARR. RETURN

DEVICE TYPE 2 - USED W/ DEVICES WHICH AUTO EXECUTE LINE FEED AFT. CARR. RETURN

W/ 2200 WONT SUPPLY LINE FEED COMMAND AFT. SYS. GENERATED CARR. ROT.

DEVICE TYPE 4 - SUPPRESSES AUTO. CARR. ROT. BY 2200 AFT. PRINT, PRTUSING, OR HEXPRINT

PRIMARY ADDR. OF EA. DEVICE ARE PRESET ON I/O CONTINUALLY BY WANG

EXAMPLES: SELECT PRINT 215 - SELECTS LP W/ DEVICE CODE OF 15

& USES LP INSTEAD OF CRT SCREEN TO OUTPUT ANYTHING RESULTING FROM PRINT, PRTUSING, OR HEXPRINT

SELECT LIST 215 - SELECT LP W/ DEVICE CODE OF 15 &

HAS LP PRINT PROGRAM LISTING

SELECT CO 215 - SELECTS LP W/ DEVICE CODE OF 15 & LP-

GETS CONSOLE OUTPUT. THIS INCLUDES ALL SYS DISPLAYS, OUTPUT

FROM STOP & END STMTS, DATA KEYS IN, OUTPUTS FROM IMMEDIATE

MODE, TRACE, & ERROR MESSAGES

LINE LENGTH - 255 CLEAR MAX. TO SET LINE LENGTH TO DESIRED LENGTH INSERT DESIRED

LENGTH IN ( ) FOLLOWING DEVICE TYPE CODE

MASTER INIT OR CLEAR SETS LINE LENGTH TO 64

LINE COUNT = 0 RETURN

*, CASE OR % AT END OF PRINT STAT CAUSES CARRIAGE RETURN

LINE COUNT = 0

3. SYS. RESET 4. CLEAR
Output which is single spaced w/ Type 2 will be double spaced w/ Type 0. Because both CPU + LP execute LF following CR.

6. Carry Ret. output when PRINT, PRINT USING, or HEXPRINT executed. HEX(0D) does not reset line count. W/ device addr. 215(80) + when exactly 80 char. are in line LP executes CR line feed aft. 80th char. The CPU - [49] WILL ISSUE A LINE FEED + LINE COUNT FOR CAUSING DOUBLE SPACE ON LP'S W/ 80 CHAR BUFFERS IN LINES W/ LESS CHAR. THAN DESIGNATED + NO PUNCH CPU CAUSES CARR. RET.

CRT Console Output - 1. All error, STOP, + END proc messages displayed along w/ immediate mode PRINT regardless of device selected for PRINT 2. When printable char. printed, CRT cursor moved 1 position to right + LINE CHAR. COUNTER incremented. If non-printable (HEX 00-0F) cursor wont move + line char. counter not incremented.

3. In ZONED format PRINT ELEMENT always printed in its entirety as if 17 char. to be printed ZONE 4 will be moved to next ZONE 1

Some devices line feed after carriage return so don't.

Most carriage returns initiated by sys., but some printers will carriage return + line feed when buffer is filled (either 80 or 132).

Device Type 0 - used to line feed for devices which don't auto LF aft. CARR. RETURN from sys. Device Type 2 - suppresses line feed w/ device that auto LF + CR Device Type 4 - suppresses sys CR aft PRRT, PRRTUSG, + HXprt w/ no trailing punct.

2200 system usually issues carriage returns. But some LP when their buffer is filled will issue their own CR (BUFFER: 80 or 132 char.)

* Should not use LINES LENGTH > CARR. LENGTH OF PRINTER OR OTHER.

2200 - generates own CR when line exceeds specified length + no CR in prog. + counts CARR. seen + printed on device, when line count = line length before + complete, CR done, LINES COUNT set to 0. + REST OF CHAR. PRINTED ON NEXT
2200 MAINTENANCE MANUAL

Device Type 4 - suppresses CR so LP's will only CR when their buffer is filled with PRT, PRTUG, or HPRT with no trailing punct. *If line length is less than buffer size, next data printed will be continued on same line with DT 4.

Select SW. on LP puts LP on-line, putting line out clears LP buffer.

Device Type 0 - will double space on most LP's because.

After each text line, 2200 issues CR/LF as well as when line count = line length.

This CR also makes LP LF on LP's w/auto LF after CR causing double space.

Device Type 4 - suppresses CR when line count = selected line length but not CR on buffer full.

You may put any combo of PRINT, LIST, or CO in SELECT start as long as you have only 1 device specified for same parameter on 80 column LP.

If select PRINT 215 + length of line to print - 80, then print 64 char, single space CR/LF, print 16 remaining char.

If select LIST 215 + length of line to print - 80, print 64 char, single space CR/LF, print 16 remaining char. Single space & print next line.

2200 ADJUSTMENTS

Adjustments, esp. Elec. Adj. only performed if parameter out of tolerance.

CPU - voltage adj. - 1. Remove 2200 PS cover for A, B, or C

2. Remove CPU cover & remove all CPU plug in circ. bros. except 1.567 pc of 2200/
3. Place L567 on extension card
4. Turn PS + CPU power on
5. Check voltages & adjust where necessary. Put grid lead to ±1V
   *NEVER ALLOW -15VR PS TO EXCEED -17 VDC OR DAMAGE CPU
     Pin1, +5VAM±0.10 VDC  R17 15 mV-p-p
     Pin2, +5VRL±0.20 VDC  R2 15 mV-p-p
     Pin12, +8VR (8.5 to 8.7 VDC) R13 20 mV-p-p
     Pin13, +12VR ±0.2 VDC  R30 15 mV-p-p
     Pin5, -12VR ±0.6 VDC  R34 35 mV-p-p
     Pin6, -15VR ±1.3 VDC  R40 25 mV-p-p
6. With scope & X1 probe measure ripple & IF exceeds limits troubleshoot CPU
7. If increase RAM capacity, add options which need more ROM IC's, add extra I/O capabilities to CPU, all voltages should be rechecked.
8. Voltages on EA, PERIP. should also be checked if it has self-contained PS
9. Replace covers

**2215 KEYBOARD** - 6348 circ. brd. w/ I/O cable in metal chassis

**6367 I/O CONTROLLER BOARD FOR 2215**

**2222 KEYBOARD** - 6330 circ. brd. w/ I/O cable 6367 I/O controller brd

**2223 KEYBOARD** - 6443 circ. brd w/ I/O cable also used as 7220 console keybrd.

6367 I/O controller brd used w/ A, B, etc. 6362 w/ ST keybrd. (2220)

**2216 VIDEO DISPLAY** - 8 X 10/2 CRT w/ CRT elec. plug-in circ. brd (Hubbard & VISA)

2 type 2216 VD an 1 BNC connector, 115/220V line sw. both on rear panel, 75ΩR on circ. brd.

b. 2 BNC conn. in front output on rear panel 75ΩR FOR TERMINATION ON REAR PANEL IN S W.

**115/220 VAC LINE SW. LOCATED ON SIDE OF CHASSIS**
2nd version may be cascaded by conn. male to Male coaxial cable from OUT BNC (from rear side sw. to left)

**1st UNIT TO INPUT BNC OF NEXT. ONLY LAST UNIT SHOULD HAVE 75ΩR SW. IN FRONT-TERM**
2200 VIDEO DISPLAY - 5½" x 7½" CRT on XM227 chassis w/CRT elec. 884.04
Cable w/BNC conn. used on 1/0 680 & display
6312 plus 6313 piggyback configuration circ. boards. for 60 Hz I/O controller
for 50 Hz 6350 used instead of 6313 w/ 6312
KYB w/ same as 2223 w/either 6367(A,B,C) or 6562(Sort) I/O controller
For optional upper/lower char. set, 6529 piggyback circ. attached to 6312(60 Hz) or 6350
2217 Cassette Drive - a TD 24(60 Hz) or a TD 24-1(50 Hz), interface
Circ. 6175, L558 & L559 & Elec. Subassembly chassis, 6324 Motherboard for L558 & L559, w/ self contained P/S.
uses 6316(A,B,or C) or 6562(Sort) I/O controller
Super Patch Board - 6327-1st revision patchboard, now obsolete
6527- 1st Superpatch, Supersedes 6327
6547 - Latest A,B, or C Superpatch, eliminates many software & disk prob. of 6527
*6547 must be used in 2200 C & will be used for A+ B
Leave 6527 in existing sys. where meets requirements of sys.
suffix ID. of SOFTWARE (ROM/PROM) circ. boards
A - 2200 A CPU  B - 2200B CPU  C - 2200C CPU
X - software extension for 6325 B or C, plug on separate PCB 6325-BX or CX
M - Matrix Option (Opt. 1) for 2200 B/C  G - General I/O (Opt. 2) for B or C
E - Edit (Opt 3) for A,B,C,S  S - Sort- sort option (Opt. 5) for B or C
K - Katakana Japanese (exclusive w/ EDIT)
*Numbers in PC board updates indicate software update
2200 S/T ROM BOARDS - 6725,12K max, phased out by 6735, 24K
12K may be used in 2200 S/T w/o changes in software variations
S/T will have 6735/7025 ROM boards.
6735 - has problems in microcode if has software option 3 chip  L23 - 377-0238 to 377-0-13
must be checked & changed: L26 - 377-0238 to 377-0292, L2 - 377-0239 to 377-0294
2200C same as 2200C w/ OPT. 1,2, & 5
6735 - contains IC's for OPT. 24 & 5 xtra IC's for disk capability
To find ROM + SUPERPATCH Boards Required - Chart Pg. 95 2200Mnt.
* GENERAL GUIDELINE ON TO USE 6527 OR 6547 SUPERPATCH
6547 required in disk sys. w/ sys. w/ intermittent  | SOFTWARE  | PROB.
* Before installing 6547 or 6527 Superpatch 2200 A/B/D8C OPTION B
3 board must be checked for proper elec. level: L558 - level 3
  6311RI - level 4  6316 - level 1
6527 & 6547 - may be plugged into any ROM board slot on 6322, 6522, or 6222
* After Installing updated ROM or SUPERPATCH - MIGHT NEED TO RE-RECORD CUSTOMER
  TAPES DUE TO CHANGES IN DATA - RESAVE PUNCH
To determine if should re-record tapes / load tapes into sys. + verify
If Error 43 note which block caused & reconstruct tape by following
a. Request 2217 from home office  
   b. Insert this 2217(ADD 0608) in I/O slot
   c. Load 1 block of error tape in sys. w/ old 2217 checking for error
   d. Record block on new 2217 & when bad block found manually register one 2217
   e. Repeat until all tapes corrected
For OPT. 23 6708 must have 377-0283 or IF none 377-0312 which disables List.
Model # gives type A,B,C,D,8,10 & amount of mem. 1-10 2200Mnt.
2200 HARDWARE

INNER HARDWARE LEVEL SUBASSEMBLIES - ARITHMETIC LOGIC UNIT, DATA MEM,
  SEVERAL REGISTERS, & I/O BUS

MACHINE LANGUAGE - BINARY LANGUAGE OF 1's & 0's - CONTROLS CPU

MICROWARE USED TO CONTROL CPU, CONSISTS OF MICROINSTRUCTIONS

OPERATOR CONTROL OUTWE COMPUTER W/ BASIC INSTRUCT.

BASIC INTERPRETER - TRANSLATES BASIC LANGUAGE TO MICROINSTRUCTIONS

  Translates 1 BASIC INSTRUCT. AT A TIME

  Executes microinstruct. at once

  Translates next basic instruct. or stat.

*Interpreters different from compilers & assemblers

Translator program for 2200 permanently stored in instruction ROM

Instruction ROM - contains all machine language necessary to control CPU

BASIC LANGUAGE PROGRAM - SOFTWARE

Translator program - sometimes called firmware

Translator program - written in sets of routines, called microroutines

  1 routine for each basic stmt

MICROINSTRUCTIONS - done sequentially but may branch if certain conditions met

Size of translator prog. held down by different microroutines using same subroutine

Microinstruct - control flow of data & type of funct. ALU to perform

ALU - requires 2 data word inputs on A & B buses, & 1 resultant data word output on C bus to perform funct. selected by microinstruct

OVER
REGISTERS

STATUS REG - 4 4-bit REG. Status REG 1 - sets RAM/ROM selection, input device inhibit & senses Spec. Function, Key & Arithmetic Carry operation.

Status REG 2 - set to indicate phase & processing mode.

Status REG 3 - sets mem. addr. mode, senses HALT/STEP, I/O device busy or other I/O oper.

Status REG 4 - set during I/O oper.

Program Control REG - 16 bit REG. Indirectly holds addr. of data words & type R/W oper works w/PC source selector which allows it to be selected.

Output - Data Mem. Addr. REG for addr. for data memory.

Auxiliary PC REG - 16 REG to temp. save & restore contents of PC REG.

Works w/Program Counter which has data sent from PC REG to AUX REG.

Data Memory Addr. REG. - receives PC REG. data & develops 11 DMA bits, Mem. Select, Write Enable addresses data words (in 8-bit RAM) & (being R/W into RAM).

Provides data selection for C Data Mem. Read REG. REG = RAM/CDS addr. from Refresh Counter.


Instruction Counter REG - 16 bit REG holds addr. of current microinstruction & increments when CK.

Subroutine Stack REG - 16 16 bit REG. hold contents of IC REG during Subroutine BR instruction.

Circular & may hold 16 bit addr. Addr. by SSR Addr. Counter.

Recurring Subroutine - overflows SS REG, so put in Mem & called called Subroutine Stack.

K I/O REG - REG. & send data to & from I/O devices.

K H REG - 4 HH order bits K L - 4 LL order bits.

C Data Memory Read Register - receives data from MSB mem or 8-bit ROM.

CH = REG 4 HH order bits CL = REG 4 LL order bits.

CH & CL together contain 8-bit DataWord.
2200 HARDWARE

MEMORY - 2 PARTS

1. MOS MEMORY (RAM) - stores data & programs
2. 8 bit ROM - math constants, text atoms, timing constants, console device info
   - Address in RAM or ROM derived from PC REG. by DMA REG.

2 modes of RAM data manipulation, set by STATUS REG 3-3

1. Horiz. Mode - R/W 2 4-bit datawords at same RAM addr. sequentially
2. Vert. Mode - R/W 2 4-bit data words

4K byte Mem - 16 2048 x 1 bit RAMs

Only 4 bits written in Mem at once. 2 cyck for 8 bit word

4 bits written 1 block of RAM. 2nd 4 bits written in another block of RAM

Data Mem. Addr doesn't change, WTEN signal changes

Read from Mem. 8 bits at time into 2-C Data Mem Read Reg.

INSTRUCTION ROM - up to 64K of 20 bit words making up BASIC INTERPRETER
SUPERPATCH - used w/ INSTRUCT ROM to correct microinstruct. Written incorrectly

Arithmetic Logic Unit - does ARITH/LOGIC FUNC.

Micro Instruction Decoder - decodes control Mem. INSTRUCT & determines if REG INSTRUCT,
Mini INSTRUCT, or BRANCH INSTRUCT.

Mini Instruction Decode - decodes mini instruct. As REG TRANSFERS & EXCHANGES, SUBROUT.

SYSTEM Timing - 10 MHz Oscillator & 4 shift REG. & Machine Cycle Counter/Decoder

Shift REG. output gated giving 16 clock times, 100 nano sec apart

Sys. Ck gen once every 16 clock times 1.68 sec

Machine Cycle Counter/Decoder - interrupts CPU machine cycle to refresh Data Mem.
Reg. Ck Decoder - enables clocks for PC, Status, K REG / Micro INSTRUCT.

B Bus Multiplexer/Selector - provides B bus input from 4 Status, K & PC REG.
Bus Select - provides ALU w B word input from File/CYCL Reg or ROM bits PAR
    addr. for A bus from ROM R7-R4

I/O Structure
  8 bit parallel I/O data path via K Reg.
  8 bit addr. for device from K Reg loaded in AB latch by CI/O instr & R7
  I/O strobo generator tells when to in or out data w/ 3 strobes

Instructions 3 types
  Register instructions, Branch Instruct, & Mini Instruct

Middleware - allows calculations & data manipulations thru software &
sets up & keeps track of pointers, flags, buffers, tables & stacks necessary
& stores in data memory for prog. execution

Data Mem. Areas
  1. Symbol Table (VSV) - defined variables & their values
  2. Value Stack (VS) - temp. hold values during expression analysis & subprog. info
  3. Operator Stack (OS) - holds operators during expression evaluation
    & FOR/GOSUB info
  4. Called Subroutines Stack (CSS) stores sub. return addr.

3 Dummy Variable Table - info. for user defined funct. (DEFINE)

Master Initialization sets trap addr. in control mem. for start of microprog.
W/MI complete & CPU enters Text Entry Phase
  During norm. oper. 3 phases: Text Entry, Variable & Line# Resolution, Exec. Execution
  Text Entry Phase - "I" or "?" identifies

Variable & Line# Resolution - triggered by RUN command

Text Atom - 8 bit code w/ 8 bit on - low 7 bits specify position of basic word
  in text atom table in CPU's 8 bit ROM - replaces basic verbs,

Commands, & funct. names
  REGISTER - ROUTINE within a ROUTINE
  EXPRESSION WITHIN AN EXPRESSION
  (VAR, EXP, TERM, FUNC)
2200 HARDWARE

OPERAND - ANY NUMERIC VALUE, SPECIFIED BY NUMBER, VARIABLE, OR FUNCTION

OPERATORS - +, -, *, /, ↑ STORED IN OS

SELECT - USED TO SELECT DEVICES FOR I/O OPER.

DEVICE TYPES - 0 = PARALLEL ASCII w/ CR/LF

1 = SERIAL 2200 CASSETTE

2 = PARALLEL ASCII w/ CR BUT NO LF

3 = DISK

4 = PARALLEL ASCII w/ NO CR GENERATED AT END OF LINE

BASIC_STMT WHICH CAN USE FILE NUMBER ASSIGNMENTS:

1. LOAD @ SAVE @ DATALOAD @ DATASAVE @ REWIND @ BACKSPACE

2. DATALOADSAVE @ DISK STENTS @ 0 @ #G10, 41 IF ON

6307/6707 1 CHIP WILL HOLD 2048 BITS, 256 BYTES
1 CHIP, 8 BITS, 1 BYTE STORED ON 8 CHIPS

8 CHIPS, 2K, 16,384 BITS, 2048 BYTES, 2K RAM
6308,6309,6310,6311 - HARDWARE PCB

2 TYPES ROM - 8 BIT ROM + 20 BIT ROM

8 BIT DECODES 1 GIVES TO 20 BIT ROM WHERE MICROPROG. IS

KEEPING IN ON KEYBOARD GOES INTO RAM

NO INITIALIZATION - CHECK VOLTAGE & EVEN IF GOOD, COULD STILL BE V REGULARIZED

OR IF NOT 6308,6309,6310,6311

L# SELECT INPUT XXX - L# SELECT CL XXX

BAD(1) - WILL REPRESENT NUMBER >= 0 BUT < 1

INT - WILL MAKE DECIMAL # AN INTEGER

& OR - RAM ... SYNTAX ERRORS
10 DIM A$(4) 10, B$(4) 10, L$(4) 2, W$(4) 2

4 Ten char variables want to put in alphabetical order; last 2 arrays needed for MATSORT.
20 MATSORT A$( ) TO L$( ), W$( )

The L$( ) array will contain the order in which alpha char appear.

30 MATMOVE A$( ) TO B$( ), L$( )

Moves variables from A$ to B$ in the order of L$, which will be alphabetical.
40 PRINT B$( )

Error 61 - Disk Format Error - Heads not staying closed; check 48V pick.

Which closes head & 24V to hold - not able to read.

Check head solenoid - oil pivot pt.; might need to format.

Error 65 - Drive only - not ready - Wang board microprocessor.

Probably bad if Ready light on - if Ready light out probably board in drive case.

Error 61 - Disk not responding correctly to 2200 - probably I/O board of CPU, disk controller board, or microprocessor of disk.

Wang boards.

Error 68 - Long redundancy check - could not read data correctly or data written wrong - probably disk controller board, multiplexer, 6311 card in CPU, or Wang card of disk.

Error 72 - Cyclic read err. - Data was either not written, written wrong or read wrong - probably R/W board, heads out of alignment, Wang boards, on disk.

Error 72+67 - Probably disk mechanical problem.

Error Lite - on "while Ready till last (reset on CP) or format 72 - on scratch from last sector."
Tape Cartridges - as look at sides using, tab on right used for write protect, hole covered = can write, hole uncovered = write protected.

DataSave DC END - need to update used parameter
Sectors & Tape are used in 256 byte blocks.

Floppy - tab must be on to write

Move (Fr or RF) - only moves Auto File Catalogue & deletes scratch file

Copy Fr (0,19583) - copy from designated sector. Everything but doesn't delete.

$ EXEC - Error 51 if has Option 2

Move Copy A$() to B$() - Error 12 if doesn't have Option 5